UNIT 5. Learning from the Past; Taking Action for the Future

> ***We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.***
>
> **Aldo Leopold**

Purpose

In Unit 4, students investigated waterfowl migration and explored how ecosystem change might affect migration. Unit 5 carries the theme of change further to look at historical changes in waterfowl populations brought about by human activity, the programs and people who have helped manage changes in the past and present, and the opportunities for students to help wildlife ecologists and land managers conserve waterfowl habitat tomorrow.

Students should understand that they get to choose which activities to pursue; the guide is designed to help them but not give them all the answers; and they're going to have fun!

Learning Objectives

If learners choose to complete all the activities in this section, they will be able to:

- Describe some past and present examples of human impacts on waterfowl populations or wetland habitat

Unit 5 at a Glance

Purpose: To examine the past and present human influences on waterfowl populations and habitat from a variety of perspectives.

Subjects: Geography, language arts, math, science, and visual arts.

Process skills:

- **Geography skills**
  - Using geographic tools
- **Language arts skills**
  - Applying knowledge to language
  - Communicating
  - Creating evaluation strategies
  - Developing research skills
  - Evaluating data
  - Gathering data
  - Interpreting
  - Participating in society
  - Questioning
  - Reading for perspective
  - Reflecting
  - Writing
- **Math skills**
  - Analyzing data
  - Collecting data
  - Computing
  - Connecting math with other subjects
  - Designing studies
  - Formulating questions
  - Measuring
  - Predicting
- **Science skills**
  - Analyzing
  - Describing
  - Gathering evidence
  - Interpreting
  - Investigating
  - Questioning
  - Thinking critically
- **Visual arts skills**
  - Applying knowledge to art
  - Connecting art to other subjects
  - Creating meaning through art
  - Designing
  - Developing visual ideas
  - Experimenting
  - Modeling
  - Sketching

Conservation concepts:

- All living things depend on habitat that includes adequate supplies and suitably arranged food, water, shelter, and space
- Ecosystems change over time
- Changes in environmental conditions can affect the survival of individual organisms and entire species.Species can become extinct because of habitat change or loss
- The impact of the human species has major consequences for other species
- Science-based management considers the needs of humans as well as wetlands and waterfowl
- Everyone should understand and participate in the stewardship and support of our natural resources

Vocabulary: climate, crossbreed, evidence, excise tax, extinction, fallow, feces, invasive species, Mississippi Flyway, opinion, peer review, phenology, plumage, stewardship, trends, weather

- Explain the possible impacts of climate change and oil spills on waterfowl populations
- Plan a stewardship activity that would benefit waterfowl through habitat restoration

Featured Artists

Meet Raina Huang and Lily Spang, Junior Duck Stamp Contest Winners

On pages 156 and 157 of the *Youth Guide*, students get to meet Junior Duck Stamp Contest winners Raina Huang (2010) and Lily Spang (2009). This section provides an opportunity for students to learn about their experiences and their inspirations for creating their winning designs.

Featured Scientist

Meet Kira Newcomb, Wildlife Biologist

As described on page 158 of the *Youth Guide*, Kira is trying to discover why the population of American Black Ducks is declining in western Tennessee. The following article describes her work and illustrates some of the steps scientists take to study waterfowl populations.

Winter Habitat Use and Survival of Female American Black Ducks in Western Tennessee

The American Black Duck has declined in much of its range since the 1950s, and loss of wintering habitat may be one important factor contributing to population decreases. Although Black Ducks wintering along the Atlantic coast have been studied, less is known about Black Ducks wintering in interior regions of the Mississippi Flyway, such as in western Tennessee. Information about interior Black Ducks is important primarily because of differences between coastal and interior palustrine wetland habitats where the ducks winter (Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, as well as small, shallow, open-water ponds or potholes. Palustrine wetlands are often called swamps, marshes, potholes, bogs, or fens. Source: http://www.conservapedia.com/Palustrine_Wetland).

Tennessee and Cross Creeks National Wildlife Refuges (NWRs) and surrounding public and private lands provide wintering habitat for most Black Ducks present in Tennessee and about half of the Black Ducks wintering in the Mississippi Flyway. Despite significant presence of Black Ducks in western Tennessee, habitat use and survival of the ducks is not well known. Furthermore, there is a need to understand how the co-occurrence of Mallards, which occupy the same areas and can hybridize with Black Ducks, may affect Black Duck habitat use and survival in the Mississippi Flyway. Key questions include whether or not Black Ducks avoid agricultural habitats often used by Mallards, whether Black Ducks seek critical habitat not provided by the NWRs on surrounding lands, and what composition and distribution of habitats enhances survival of Black Ducks. This information is vital for guiding management strategies at the NWRs and conservation planning by the Black Duck Joint Venture and other agencies.

Mississippi State University, the University of Tennessee-Knoxville, and the U.S. Fish and Wildlife Service (USFWS) teamed together to study Black Duck winter ecology during winters 2010-2011 and 2011–2012. The study on the Duck River Unit of the Tennessee National Wildlife Refuge was initiated in November 2010. As the Black Ducks arrived, researchers trapped, banded, and attached radio transmitters to approximately 100 females. Radio-marked ducks were followed daily by vehicle and semiweekly by airplane to record movements, habitat use, and estimate survival of these birds in

important habitats in western Tennessee. This information will be critical for better understanding habitat management needs at these interior NWRs. The results will provide USFWS with the opportunity to make science-based habitat management decisions that will help sustain Black Ducks wintering at Tennessee National Wildlife Refuge.

Unit 5. Activities Preparation Tips

Background information

WATERFOWL MIGRATION … AND COLLABORATIVE MANAGEMENT

The North American Waterfowl Management Plan

In the mid 1980s, waterfowl populations were in crisis. A 10-year-long drought and the draining of wetlands for agricultural and other uses were taking their toll on the birds' habitats and subsequently on them. Because waterfowl were then (and are now) North America's most prominent and economically important group of migratory birds, the U.S. and Canadian governments took action. Scientists, from inside and outside the government, were asked to identify "waterfowl habitat areas of major concern" across the continent and to develop a conservation plan. The *North American Waterfowl Management Plan* was signed by the U.S. Secretary of the Interior and the Canadian Minister of the Environment in 1986.

The scope of the conservation effort needed left no room for doubt: acting alone, the two federal governments did not have the resources needed to save these vital habitats. It was from this dilemma that the concept of conservation joint ventures was born: private- and public-sector partners working together to conserve the continent's waterfowl populations and their essential habitats.

Conservationists concerned about other migratory bird groups—landbirds, shorebirds, colonial waterbirds—saw the success of the Plan model and adopted it as they developed conservation strategies for their species of concern. Rather than reinvent the wheel, they looked to the Plan's joint ventures to help implement their plans. Within their established geographic areas, the Plan's habitat joint ventures, when possible, have integrated the conservation of shorebirds, landbirds, and other waterbirds into their planning processes.

What is a Joint Venture?

A Migratory Bird Joint Venture (JV) is a collaborative, regional partnership of government agencies, non-profit organizations, corporations, tribes, and individuals that conserves habitat for priority bird species, other wildlife, and people.

Migratory Bird Joint Ventures bring these diverse partners together under the guidance of national and international bird conservation plans to design and implement landscape-scale conservation efforts.

Conservation in Action

Migratory Bird Joint Ventures have been widely accepted as the model for collaborative conservation in the 21st century. They use state of the art science to ensure that a diversity of habitats is available to sustain migratory bird populations for the benefit of those species, other wildlife, and the public. JV activities include:

- biological planning, conservation design, and prioritization;
- project development and implementation;
- monitoring, evaluation, and research;
- communications, education, and outreach; and
- funding support for projects and activities.

Partnerships That Work

Nationwide, 18 habitat-based JVs address the bird habitat conservation issues found within their geographic area. Three species-based JVs, all with an international scope, work to further the scientific understanding needed to effectively manage specific bird species.

Migratory Bird Joint Ventures have a 25-year history of success in leveraging public and private resources to bring together partners and focus on regional conservation needs.

Since the first Migratory Bird Joint Venture was established in 1987, JV partnerships have invested $5 billion to conserve 17.3 million acres of critical habitat.

Wetland and Waterfowl Management Collaboration[1]

One of the first things waterfowl managers learned from their early waterfowl banding efforts was that waterfowl follow distinct, traditional migration corridors or flyways in their annual travels between breeding and wintering areas. Since 1948, waterfowl have been managed by four administrative flyways that are based on those migration paths: the Atlantic, Mississippi, Central, and Pacific Flyways. Each flyway has a flyway council which is a formal organization composed of one member from each State and Province in that flyway. Recently, Mexico has also provided representation at Pacific and Central Flyway meetings and discussions.

Each of the flyways also has a technical committee composed of waterfowl biologists from the states and provinces in the flyway. The technical committees meet several times annually to review the biological data from monitoring programs and provide recommendations to their respective flyway councils. Recommendations that are adopted by the flyway councils are presented to the U.S. Fish and Wildlife Service's Regulations Committee for consideration in the setting of waterfowl hunting regulations and management programs.

The flyway councils and technical committees are involved in many aspects of migratory game bird management, including development of recommendations for hunting regulations and assisting in research and habitat management activities. Some of the important waterfowl hunting regulations that are set each year, including season length and daily bag limits, are specific to these individual flyways. Carefully regulated hunting is an important tool in the management of waterfowl populations.

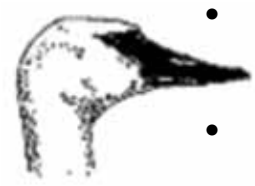
See General Flyways Info, http://www.flyways.us/flyways/info, for information on each of the four administrative flyways.

[1] Adapted from General Flyways Info, http://www.flyways.us/info

Swans

Swans belong to the same family of birds as geese and ducks, Anatidae, and there are three different species found in the U.S.: Trumpeter, Mute, and Tundra. A swan gliding across the water may be a beautiful sight. Not all swans, however, are native to the U.S.

Trumpeter Swans *(Cygnus buccinator)* are the largest waterfowl in North America and the largest swan in the world. They are native to the U.S., but their populations declined during the 19th century when they were hunted for their meat and feathers. By 1930, fewer than 100 Trumpeter Swans remained in the U.S.



Identification Tips:

- Length: 45 inches Wingspan: 95 inches
- Large, long-necked waterbird with short legs and a short, duck-like bill
- Long neck held straight up with a kink at base

Adult:

- Black bill
- Black of bill extends up to eye but does not encircle it
- V-shaped demarcation on forehead between black bill and white feathering
- Black legs and feet
- Entirely white plumage
- Sexes similar

Diet:

- Almost Exclusively:
  - Green Plant Matter
  - Seeds
- Lesser Quantities of:
  - Aquatic Invertebrates

Mute Swans *(Cygnus olor)* are an indigenous species to Europe and parts of Asia and were introduced into North America as a decorative waterfowl for parks, zoos, and private estates during the later 1870s. However, by the early 1900s, a small number of birds escaped into the wild in New Jersey and New York.

Identification Tips:

- Length: 40 inches
- Large, long-necked waterbird with short legs and a short duck-like bill
- Long neck held in distinctive “S” curve at rest

Adult:

- Orange bill with black base, lores and knob above bill
- Black legs and feet
- Entirely white plumage
- Fluffy back feathers
- Female has smaller bill knob
- Sexes similar

Diet:

- Almost Exclusively:
  - Plant Matter
- Lesser Quantities of:
  - Aquatic Invertebrates

Tundra Swans *(Cygnus columbianus)* were formerly known as whistling swans. They are smaller than the Trumpeter and Mute Swans and breed in the far northern regions of North America.

Identification Tips:

- Length: 36 inches Wingspan: 85 inches
- Large, long-necked waterbird with short legs and a short, duck-like bill
- Long neck held straight up with a kink at base

Adult:

- Black bill with variably-sized yellow spot at base
- Black of bill extends up to eye but does not encircle it
- Straight demarcation on forehead between black bill and white feathering
- Black legs and feet
- Entirely white plumage
- Sexes similar

Diet:

- Almost Exclusively:
  - Green Plant Matter
  - Seeds
- Lesser Quantities of:
  - Aquatic Invertebrates

(Swan illustrations courtesy of Wisconsin Department of Natural Resources)

Notes:

Purple Loosestrife[1]

Purple loosestrife, the beautiful purple plant found in many wetlands and moist soil areas, is an exotic species of Eurasian origin and a threat to the viability of North American wetland habitats. In Europe and Asia, purple loosestrife is a minor component of wetland habitats and not the dominant species it tends to be in North American wetlands. The major difference involves the lack of the plant's natural enemies. Natural enemies did not accompany purple loosestrife when it arrived in North America during the early 1800s. This, along with the plant's ability to grow in a variety of soil types and in various depths of water, has given purple loosestrife a competitive edge over North America's native wetland plants.

Purple loosestrife typically infests areas where native wetland plant communities have been disturbed. This includes man-made disturbances such as digging or moving wetland soils with tractors and bulldozers, as well as natural disturbances like droughts and floods. Purple loosestrife spreads primarily by seed germination in moist soil areas. A typical 3-year-old plant can produce in excess of one million seeds.

The impact of this weed on North American wetlands has been disastrous. Native wetland plants have been crowded out by purple loosestrife. This in turn causes a reduction in suitable habitat for wildlife, particularly waterfowl and waterbirds, and reduced productivity for those species which depend on aquatic ecosystems.

Impact of Purple Loosestrife on Waterfowl[2]

The Canvasback (*Aythya valisineria*) has never recovered from the low levels of the great "duck depression" brought on by the disastrous drought of the early 1930s. The species has been nearly simultaneously beset with loss of nesting habitat in the Prairie Pothole Region and a gradual decline in the quality of its restricted wintering grounds (Trauger, 1974). Its preference for platform nests built over water in cattail, *Typha latifolia*, or hard-stem bulrush, *Scirpus acutus* (Stoudt, 1982), makes it vulnerable to encroachment by purple loosestrife. Fortunately, *L. salicaria* seems to be slow in colonizing the Prairie Pothole Region. A plant was collected at Neepawa in 1896 (Stuckey, 1980), but the species did not begin to spread into Manitoba wetlands until after 1950. It may prove to be less vigorous than native plants in competing for space under the harsh and widely fluctuating climatic patterns of the northern prairies. The relative isolation of prairie pothole sloughs also makes spread by waterborne propagules a slow process. Nevertheless, it invaded Delta Marsh in 1955 and has required vigorous local control in disturbed areas along the marsh edge (H. Hochbaum, personal communication; Friesen, 1966). With drawdown or drought, *L. salicaria* could threaten the deep-water nesting areas of the canvasback at Delta.

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[1] From *Purple Loosestrife*, Montezuma National Wildlife Refuge, U.S. FWS, http://www.fws.gov/r5mnwr/mnwrls.html

[2] Adapted from *Impact of* Lythrum salicaria *on Wetland Habitats and Wildlife, Spread, Impact, and Control of Purple Loosestrife* (Lythrum salicaria) *in North American Wetlands*, Northern Prairie Wildlife Research Center, USGS: http://www.npwrc.usgs.gov/resource/plants/loosstrf/impact.htm

Saving Great Lakes Wetlands: Today, vital habitat in this waterfowl-rich region faces a host of threats, Tina Yerkes, Ducks Unlimited[1]

The Great Lakes contain 20% of the world's fresh water, sustain an economy for 30 million people, and support millions of waterfowl throughout their annual cycle. This massive watershed drains 201,000 square miles and has over 10,000 miles of shoreline, which is more than the Atlantic and Pacific coasts combined.

The Great Lakes in North America are important for drinking water, sport and commercial fishing, waterfowl hunting, and other recreational activities. Some of the oldest hunting clubs in the U.S. and Canada are found along the shores of the Great Lakes, where waterfowlers still pursue Mallards, Black Ducks, Canvasbacks, and Lesser Scaup.

Conserving the region's waterfowl habitat is wrought with challenges, including invasive species, expanding human populations, continued loss and degradation of habitat, and the effects of climate change. Nonnative species, such as the Zebra Mussel and purple loosestrife, are disrupting food webs and causing billions of dollars in damage to infrastructure and fisheries.

Birds that eat Zebra Mussels, which are filter feeders, ingest heavy metals and other toxins. Phragmites (common reed) and purple loosestrife displace native plants that provide nesting cover and food for waterfowl and other wetland species. Biologists have documented at least 185 invasive species in the Great Lakes system, and a new one is introduced every month.

The Great Lakes watershed has lost 62% of its original wetlands, and some parts of this region have lost more than 90% of these habitats. Such extensive losses have created a highly fragmented landscape. Unfortunately, the most critical challenge for Great Lakes waterfowl is the continued destruction and degradation of habitat, including the coastal and inland wetlands and river corridors the birds depend on. Habitat loss in the region results from a combination of urban expansion and changing agricultural practices. Despite laws and regulations intended to protect wetlands, the Great Lakes watershed continues to experience losses of small, seasonally flooded wetlands, which are critically important for waterfowl.

The Great Lakes and adjoining states.
Image courtesy of the National Oceanic and Atmospheric Administration

[1] Adapted from: http://www.ducks.org/conservation/where-we-work/us-great-lakes-system/saving-great-lakes-wetlands

Urban Waterfowl

The fact that people, concerned about the health and well-being of waterfowl, shouldn't feed birds might surprise students. The following article illustrates why we should…

Stop Feeding Waterfowl[1]

Some people enjoy feeding waterfowl. They visit lakes, ponds, and town parks to toss bread, corn, popcorn, or table scraps to the ducks and geese that congregate in these places. Some people say that it makes them feel good to help the ducks … that it brings the ducks closer for their kids to see … that it's an escape from the daily grind.

Is it good to feed waterfowl? No, artificial feeding is actually harmful to waterfowl. Artificial feeding of waterfowl can cause:

- Poor nutrition
- Increased hybridization
- Water pollution
- Delayed migration
- Concentrations at unnatural sites
- Overcrowding
- Spread of disease
- Costly management efforts
- Unnatural behavior
- Cumulative effects
- Devaluation of the species

Read on to explore this issue and decide for yourself whether you want to continue feeding waterfowl.

Nutrition

It would seem that providing food for ducks and geese would make them healthier. However, this is not the case. Waterfowl at artificial feeding sites are often found to suffer from poor nutrition. In natural settings, waterfowl seek and feed on a variety of nutritious foods such as aquatic plants, natural grains, and invertebrates. Many of the items commonly used to feed waterfowl (bread, corn, popcorn, etc.) are low in protein and are very poor substitutes for natural foods.

Natural foods are also widely scattered. Ducks and geese are able to find these foods and eat them in relative seclusion. At artificial feeding sites, competition for each scrap or kernel is high. Some ducks and geese (usually the youngest) are unable to compete for handouts.

[1] Adapted from *Stop Feeding Wildlife*, New York State Department of Environmental Conservation. http;//www.dec.ny.gov/animals/7001.htm.

Visible symptoms of poor nutrition and advanced stages of starvation are often seen at artificial feeding sites. For example, waterfowl may have drooping wings or may lose their ability to fly.

Disease

When ducks and geese feed on scattered corn or bread, they eat in the same place where they defecate. This is not healthy. In addition, large concentrations of waterfowl can facilitate the spread of disease. Also not healthy. Diseases generally not transmissible in a wild setting find overcrowded and unsanitary conditions very favorable.

Most waterfowl die-offs in the past ten years have involved artificial feeding:

- 2,000 Mallards and Black Ducks were killed in an outbreak of Duck Virus Enteritis in Central New York.
- Another fatal disease, *Aspergillus*, occurs when food is scattered too liberally, it piles up, and becomes moldy
- In Cheektowaga, New York, hundreds of ducks were killed in an outbreak of Avian Botulism at a feeding site. A local ordinance was later passed to prohibit the feeding of waterfowl. An added bonus ... rat populations that fed well on waterfowl handouts have since declined

In some cases, humans have been affected by disease transmitted by waterfowl. In Skaneateles, New York, swimmers contracted Swimmer's Itch, caused by a parasite that was emitted from ducks attracted to artificial feeding at the town park.

Overcrowding

Feeding attracts birds in unnatural numbers, beyond natural food and water supplies, and frequently in numbers beyond what people will tolerate. Over-grazed and badly-eroded lawns, golf courses, and school playing fields are often the result of overcrowding. Grassy areas such as ball fields and golf courses can become unsanitary and unusable. In Dutchess County, New York, recreational areas were forced to close down until goose droppings could be cleaned up.

Delayed Migration

Feeding alters normal migration patterns of waterfowl by shortening or even eliminating them. Ducks, reluctant to leave in the winter, may not survive sudden cold. If the artificial feeding is stopped in time, ducks and geese can quickly adapt to finding natural foods and will follow their companions south. In West Haven, Connecticut, 30 swans died from starvation at an artificial feeding site during the harsh winter of '93–'94. Meanwhile, over 800 swans survived nearby on natural food.

Unnatural Sites

Artificial feeding often attracts birds to human habitats—parking lots, fast-food restaurants, and retention ponds—where they are more subject to accidental death. Natural cover, which can provide protection from bad weather and predators (even dogs and cats), is often lacking at these feeding sites.

Unnatural Behavior

Waterfowl can rapidly become conditioned to, and dependent on, handouts. Fed ducks and geese behave differently. They become more aggressive and eventually lose their wariness of humans. Some will not survive because they can't compete. Many will lose the quality which endears them to most people, their wildness.

Increased Hybridization

At many feeding sites, domestic ducks have interbred with Mallards, further compromising the wild population.

Water Pollution

Excess nutrients in ponds caused by unnatural numbers of waterfowl droppings can result in water-quality problems such as summer algal blooms. And where waterfowl congregate to feed, bacterial counts from feces can swell to levels that make the water unsuitable for swimming.

Costly Management Efforts

Many damage-avoidance techniques such as chemical repellents, fencing, or noise makers are costly and may even be useless once animals lose their fear of humans. At times, it is necessary to destroy nuisance waterfowl because of the damage they cause.

Devaluation

From treasure to nuisance... wildlife managers recognize that the public's perception of the value of wildlife is often reduced when numbers swell. When any wildlife population exceeds the number that can be naturally supported by available habitat, this can polarize the public and exaggerate conflicts between landowners who suffer damage and those who visit the site to feed the geese and ducks.

Cumulative Effects

It may be hard to imagine that a handful of bread or a stray french fry could contribute to such a growing problem. Compound that, though. In most cases where artificial feeding occurs, one well-intentioned feeder leaves and another soon arrives.

People Love Waterfowl

- A birdwatcher searches wetlands for hidden sightings and travels cross-country to see different species
- A farmer pauses from his chores to gaze skyward and take in the sights and sounds of a "V" of geese
- A hunter pats the head of his trusted hunting dog for quickly returning a bird to the blind
- Parents take their children to see ducks at the town park or wildlife refuge

Yes, people love waterfowl and care about their well-being! Please consider the effects of feeding waterfowl, and do what's right.

Each person that cares enough to become educated about the effects of artificial feeding can make a difference. This problem requires cooperation from everyone, but the solution starts with each individual. One person may choose to discontinue feeding. Another person may decide to put up a sign to discourage others from feeding.

Alternatives

If everyone stops feeding waterfowl, the waterfowl won't disappear. Families can still visit sites to enjoy viewing ducks and geese. A child can still be encouraged to learn more about waterfowl and their natural habits. And some zoos offer feeding of captive waterfowl.

Clearly, you do not need to feed waterfowl in order to enjoy them. In fact, it should be apparent now that the best thing you can do for the overall benefit of waterfowl is to stop artificial feeding.

Waterfowl Population Surveys—How do scientists count waterfowl populations? As illustrated in the article below, with the help of hunters and other citizens who voluntarily monitor birds. See the *Related Resources* section on page 137 for more information on monitoring techniques.

Harvest Diary Surveys[1]

National harvest surveys of sport hunters have been conducted annually since 1952 in the U.S. and since 1967 in Canada. Although these surveys have undergone some changes since their inception, they are conducted by mail and consist of asking selected waterfowl hunters to report the number of ducks and geese they harvested during the hunting season. These surveys provide annual information that allows biologists to evaluate long-term trends in harvest, hunter numbers, and hunting pressure.

Typically in the late summer of each year, the U.S. Fish and Wildlife Service (USFWS) releases a summary of hunter activity and harvest from the previous year.

The most recent summary report at the time of publishing was from 2009. More than 13.1 million ducks were harvested in the U.S. during the 2009–2010 waterfowl hunting season, according to these preliminary estimates. This is down from 13.6 million ducks harvested the previous season.

United States

Currently in the U.S., the *Cooperative State-Federal Migratory Bird Harvest Information Program* (HIP) is the program the U.S. Fish and Wildlife Service and the states use to produce reliable estimates of all migratory bird harvest across the country. In a nutshell, here's how the program works: The state agencies collect the name and address of every migratory bird hunter who purchases a hunting license, and they send that information to the U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service selects a random sample of hunters in each state, and mails them a diary survey form. Finally, the U.S. Fish and Wildlife Service uses the hunters' responses on the survey forms to estimate harvest and hunter activity at the state, flyway, and national levels.

[1] From Flyways.US, http://flyways.us/surveys-and-monitoring/hunter-surveys/harvest-diary-surveys

States have the most difficult job—identifying all of the migratory bird hunters in their state. Most states use their licensing systems to identify migratory bird hunters and to collect hunter name and address. Once identified, hunters are asked a series of standard "screening" questions about the species they hunted and their hunting success the previous year. Contrary to popular belief, hunters' answers to these questions are not used to compile harvest estimates, but simply to identify what types of migratory birds they usually hunt. This allows the U.S. Fish and Wildlife Service to mail surveys to the appropriate types of hunters. HIP certification is mandatory for all migratory bird hunters in every state in which they hunt.

The U.S. Fish and Wildlife Service receives name, address, and screening question information from about 3,500,000 migratory bird hunters each year. The U.S. Fish and Wildlife Service selects a random sample of hunters from this list and mails them a hunting diary form and asks each hunter to record the date, location and number of ducks and geese taken for each day of waterfowl hunting. Survey forms are usually mailed out at the beginning of the hunting season or shortly after the U.S. Fish and Wildlife Service receives the selected hunters' names and address information from the states.

After the end of the hunting season, the U.S. Fish and Wildlife Service sends reminder letters and replacement survey forms to the sampled hunters (if necessary), and asks them to complete and mail back their hunting diaries. About 70,000 waterfowl hunters are selected annually for this survey. Responses from hunters who choose to participate are kept strictly confidential. Participation is voluntary, and on average, the response rate is about 60%. In addition to the HIP waterfowl survey, the U.S. Fish and Wildlife Service also conducts four other harvest surveys, including: 1) Doves and Band-tailed Pigeons, 2) Woodcock, 3) Snipe, Coots, Rails and Gallinules, and 4) Sandhill Cranes.

Hunters' survey responses are analyzed using standard statistical techniques and are used to estimate the total harvest of ducks and geese, the number of active hunters, the total days hunters spend afield, and the average seasonal bag per active hunter.

PENCIL-TO-PAPER WARM-UP

Description: Students add a new layer to their *geo*-bird drawing, which describes how the influences of humans might alter the habitat of their *geo*-bird. They compare their new sketch with their *geo*-bird drawings from Unit 4 and share their ideas with classmates.

Setting: Indoors

Skills: Connecting art to other subjects, describing, developing visual ideas, explaining, sketching

Preparation: Students, particular younger students, may need to see photos, diagrams or videos depicting waterfowl/human interactions before initiating this activity. Search the Internet for urban waterfowl, hunters, or waterfowl in agricultural fields, and find resources in the Unit 5 *Related Resources* list, page 137.

Unit 5 *Explore* and *Investigate* activities have been grouped according to the following four themes: Urban Waterfowl; Species in Decline; Climate Change; and Habitat Gain and Habitat Loss.

Theme: Urban Waterfowl

Learning Objective:

On completing the *Explore* and *Investigate* activities described below, learners will be able to:

- Describe the challenges of managing urban waterfowl

EXPLORE

Urban Waterfowl – Make Way for Ducklings and Goslings!

Description: Students watch a video of Sebastian the goose talking about how great it is living on lake-side lawns. They are asked to speculate about the pros and cons of having geese in urban areas and about solutions to discouraging unwanted geese.

Setting: Indoors

Skills: Describing, inferring, comparing, analyzing

Materials: Nature Notebook and a pen or pencil, access to YouTube

INVESTIGATE

Urban Waterfowl

Description: Students apply skills learned in Units 1– 4 to formulate questions and hypotheses about urban waterfowl issues, particularly those caused by geese and Mallards.

Setting: Indoors

Skills: Describing, reading for perspective, questioning, thinking critically

Materials: Nature Notebook and pencil or pen, and worksheet on page 167 of *Youth Guide*

Theme: Species in Decline

Learning Objective:

On completing the *Explore* activities described below, learners will be able to:

- Interpret simple data to predict waterfowl population changes

EXPLORE

Species in Decline: Scaup, Pintail, and Common Eider

Description: Students read about the characteristics of three waterfowl species. They're given three problems and three possible solutions relating to waterfowl decline. In a small group, they match one problem and one solution to each of the three species.

Setting: Indoors

Skills: Describing, developing research capabilities, gathering evidence, identifying, recording

Materials: Nature Notebook and pen or pencil

INVESTIGATE

Species in Decline: The Ups and Downs of Duck Populations

Description: Students consider data on declining duck species, use Internet or library resources to gather data about the species, and then speculate why the species are in trouble. Pintail, Mottled Duck, Black Duck, and Tree Duck populations have decreased, as well as Steller's and Spectacled Eider Ducks (these last two are closely related to the Labrador Duck and thus may provide some clues to its extinction).

Setting: Indoors

Skills: Analyzing, describing, evaluating, interpreting data

Materials: Nature Notebook and a pen or pencil; access to a library or the Internet to find resources on declining species, and graphs of duck population data and data worksheet from pages 178–180 of the *Youth Guide*

Theme: Climate Change

Learning Objective:

On completing the *Explore* activities described below, learners will be able to:

- Distinguish between fact and opinion as they consider climate change data and waterfowl conservation issues

EXPLORE

How Do You Know What to Think about Climate Change?

Description: In this four-part activity on climate change, the focus is on gathering evidence to distinguish between fact and opinion. Students may choose to: consider climate change in general and the importance of gathering evidence; analyze media reports, collect their own data, explore the variables related to climate change studies; and/or investigate climate information for their own state.

Setting: Indoors

Skills: Applying knowledge to language, communicating, describing, evaluating data, gathering evidence, measuring, questioning, thinking critically

Materials: Nature Notebook and a pen or pencil; library or Internet access for climate change research, the worksheet and sample graphs for your Nature Notebook on page 184 of the *Youth Guide*

INVESTIGATE

Using Data to Learn about Climate Change

Description: Students examine data from the Wisconsin State Climatology Office and their own state's office of climatology to look for trends, hottest and coldest years, and other records of interest.

Setting: Indoors

Skills: Describing, evaluating data, gathering evidence, measuring, questioning, thinking critically

Preparation: Investigate sources of climatology information from state agencies in your state.

Materials: Nature Notebook and a pen or pencil; the diagram of Wisconsin Statewide Average Annual Temperature on page 185 of the *Youth Guide*

Theme: Habitat Gain and Habitat Loss

Learning Objectives:

On completing the *Explore* and *Investigate* activities described below, learners will be able to:

- Develop a question and hypothesis related to the human influences on waterfowl populations
- Identify at least one local, invasive species
- Explain the basic impacts of oil spills on waterfowl populations

EXPLORE

Habitat Gain and Habitat Loss

Description: Students consider issues that often arise concerning community development and wetland conservation.

Setting: Indoors

Skills: Evaluating, interpreting, questioning, reflecting, thinking critically

Materials: Nature Notebook and pencil or pen

Invasive Species

Description: Students can choose from two activities on invasive species. One activity focuses on the invasive purple loosestrife and its effects on waterfowl. The other, encourages students to get involved in a stewardship project that uses GPS technology to manage invasive species.

Skills: Analyzing data, communicating, developing research skills, gathering data, questioning, using geographic tools

Materials: Nature Notebook and pen or pencil, access to the Internet and/or library

Oil Spills

Description: Ecosystem change is a natural process and, as with flooding, can be beneficial to wetland habitats and wildlife. Large-scale human-caused ecosystem change, like an oil spill, is often catastrophic for wildlife. In this activity students consider information about two U.S. oil spills and their effects on waterfowl populations over time.

Setting: Indoors

Skills: Describing, gathering evidence, questioning

Materials: Nature Notebook and a pen or pencil

Access to History

Description: Students research local media archives to learn about waterfowl and human interactions, and about waterfowl conservation needs in their own community.

Setting: Indoors

Skills: Describing, developing research skills, gathering evidence, questioning, reading for perspective

Materials: Nature Notebook and a pen or pencil; library or Internet access media research (local and national newspaper archives, magazine archives, local TV archives)

INVESTIGATE

Oil Spill in the Gulf: People Making a Difference

Description: Students read four stories about real people who responded to the Gulf Deep Horizon Oil Spill. They then try to identify the conservation goal that person was trying to meet and the skills that they brought to the task. This activity highlights positive actions that people were able to take to help make a difference during the Gulf oil spill. Look up Olivia Bouler/Audubon as an example of kids taking action and making a difference. Challenge students to brainstorm ways they could take action and make a difference to prevent oil-related disasters.

Setting: Indoors

Skills: Communicating, describing, participating in society

Materials: Nature Notebook and pen or pencil

EXPRESS

Learning Objectives:

On completing the *Express* activities described below, learners will be able to:

- Describe in writing the decline of a local waterfowl species
- Plan a stewardship activity related to wetland restoration

Write

Description: Students write a mystery story about a waterfowl species that is in decline, using real facts about that species and its habitat needs.

Setting: Indoors

Skills: Communicating, connecting language to other subjects, developing research skills, describing, interpreting, observing

Materials: Nature Notebook and pen

Draw

Description: Students learn about writer, cartoonist, and conservationist "Ding" Darling and then draw their own cartoons mimicking his style and techniques.

Setting: Indoors

Skills: Applying knowledge to art, connecting art to other subjects, developing visual ideas, experimenting, sketching.

Materials: Nature Notebook, pen or pencil

Restore

Description: Students find resources to help them plan a wetland or waterfowl conservation activity.

Setting: Indoors

Skills: Participating in society

Materials: Nature Notebook, pen or pencil, art pencils, charcoal sticks, colored pencils, paints or other art materials as requested by students

SHARE

Learning Objectives

On completing the *Share* activities described below, learners will be able to:

- Communicate, within their school community, their newly acquired knowledge and skills related to wetlands and waterfowl

An Art Contest of Your Own:

Description: In this two-part activity, students work with the school librarian and/or the community librarian to collect waterfowl-related materials that could help them illustrate what they found most interesting about the interactions of people and waterfowl. Next, students plan a waterfowl art contest for their school containing works that depict the relationships and interactions of people and waterfowl in their community. If your school does not already host a Junior Duck Stamp art competition, work with your students to set one up.

Setting: Indoors

Skills: Communicating, connecting art to other subjects, describing, developing visual ideas, participating in society, working independently and collaboratively

Materials: Nature Notebook, pen or pencil

Mystery of the Labrador Duck – Evidence about Interaction with People

Description: Students add another piece of evidence (human influences) to their Labrador Duck mystery notes to try to solve the mystery of this species' extinction. They then review their Labrador Duck clues from each unit and choose one that seems the most likely to them.

Setting: Indoors

Skills: Communicating, describing

Materials: Nature Notebook, pen or pencil

PENCIL-TO-PAPER WRAP-UP

Students revisit the *geo*-bird created in the *Warm-Up* section of this unit (page 159 in the *Youth Guide*). Encourage them to think about what they learned in Unit 5. Students should update their drawing to reflect their new knowledge about the relationships between human influences and waterfowl habitat and survival.

Adaptations for Early Elementary Students

As suggested by the *NAAEE Excellence in Environmental Education: Guidelines for Learning (K–12)*, strategies for examining environmental issues with early elementary student should be simple, local, and make close links between what they're observing and learning about the local environment.[1]

ACTION – *Helping Wetland Habitats* is a K–12, *Wonders of Wetlands*[2] activity that provides directions for improving a wetland site.

URBAN WATERFOWL – **Are Waterfowl in Your Community a Nuisance or Welcomed Species?**

What problems do waterfowl cause in cities? They have to eat, drink, defecate, sleep, nest, raise young, and fly as part of their normal routines. What problems might these activities cause for people? What benefits are there from having waterfowl living within our cities?

Make copies of the article, "Stop Feeding Waterfowl" (page 125) for each student. Students should read the article.

[1] *Excellence in Environmental Education: Guidelines for Learning (K–12)*. 2010. North American Association for Environmental Education, www.naaee.org

[2] *Wonders of Wetlands*, Environmental Concerns, http://www.Wetland.Org/publications_home.htm

Have students make a chart, like the one below, in their Nature Notebook:

Are Waterfowl in Your Community a Nuisance or Welcomed Species?		
Waterfowl activities	**Problems for people**	**Benefits for people**
Example: Raising young	Cross roadways Become aggressive to protect young	Fun and interesting to watch

Then ask them to fill in at least one activity, problem, and benefit in each box. When they have completed their work, have a group discussion about whether they think the benefits of having urban waterfowl outweigh the problems they create.

Check the *Related Resources* list on page 137 for curricula, activities, and materials that are appropriate for grades K–4.

Adaptations for High School Students

Thinking about U.S. Fish and Wildlife Service Careers

Throughout the curriculum we highlighted the interesting roles that scientists and non-scientists take on to help conserve wetlands and waterfowl. This additional activity emphasizes the variety of roles available through the U.S. Fish and Wildlife Service to help in their wetland management efforts.

1. Download copies of the fact sheet, *Careers: Conserving the Nature of America* from the U.S. Fish and Wildlife Service website: http://www.fws.gov/humancapital/factsheetpdfs/2FWS%20Careers%20hc%20A%208.pdf
   Each student will need a copy.
2. Ask students to brainstorm what skills they might bring to a wetland or waterfowl conservation effort. Have them write their ideas in their Nature Notebook.
3. Pass the fact sheet out to each student.
4. First ask the students to circle the career possibilities they would like to pursue, if any. Then ask them to put a star next to the career titles that match the skills they wrote in their Nature Notebook.
5. Hold a classroom discussion about how many students had circled and starred any of the same career titles. Brainstorm ideas about what students would need to do to develop the skills needed for the careers they circled. Ask a natural resource professional to participate in this discussion if possible so s/he can elaborate on job descriptions as needed.

***Science and Civics: Sustaining Wildlife*, Project WILD Curriculum for Grades 9–12 (www.projectwild.org/scienceandcivics.htm)**

This curriculum contains activities related to wildlife and human interactions that could be adapted for waterfowl conservation, such as:

- ***Limits to Living Here:*** *Students will interpret a graph of changes in an animal population over time, hypothesize relationships in the ecosystem, and predict population distributions.*
- ***How to Evaluate Habitats:*** *Students will map and survey a school or community area to compile a full description of site conditions and populations, to assess the biotic and abiotic features, to research the needs of animals native to the site, and to rate the ability of the habitat to meet those needs.*

It also includes a section that provides guidelines for stewardship activities called *Taking Action*.

Check the *Related Resources* list below for curricula, activities, and materials that are appropriate for grades 9–12.

UNIT 5 – RELATED RESOURCES

Activities

Ecosystem Phenology (7–12th), Wisconsin Department of Natural Resources, *CLIMATE CHANGE: A Wisconsin Activity Guide, Grades 7–12th*
http://dnr.wi.gov/org/caer/ce/eek/educator/Climateguide/PDF/03-4245-phenology.pdf

DVD or Video

America's Duck Chaser (Web video), *Status of Waterfowl*, Flyways.us
http://www.flyways.us/status-of-waterfowl?phpMyAdmin= 31cf681b01b6663384007aa1cfa655cd
Watch pilot biologists survey waterfowl populations.

Sebastian the Goose Encourages Natural Shoreline (Web-video), University of WI-Madison, Life Sciences Communications
http://www.youtube.com/watch?v=ZkJF6x48fwU
Ever wonder why geese seem to gather on your favorite picnic spot, lake front shoreline, or backyard? It's explained in this one-on-one interview with Sebastian, the freeloading fowl.

Winged Migration (DVD), Jacques Perrin, Sony Pictures, 89 mins.
This movie offers a birds-eye view of the world's bird migratory routes.

Print resources

Atlas of Bird Migration: Tracing the Great Journeys of the World's Birds. (2007). Elphick, J. & Lovejoy, T.E. Smithsonian Institution. Firefly Books.

Make Way for Ducklings, Robert McCloskey

Web resources

Art, Science, and Nature

These sites highlight the work of people or projects that combine the arts, science, and nature.

- Keepers of the Waters: http://www.keepersofthewaters.org/
- Lynne Hull: http://www.eco-art.org/
- Lorna Jordan: http://lornajordan.com
- Patricia Johansen: http://www.patriciajohanson.com
- Mel Chin: http://www.satorimedia.com/fmraWeb/chin.htm

Climate Change

Conservation in a Changing Climate, USFWS
http://www.fws.gov/home/climatechange/
This site offers basic climate change information as well as information on wildlife impacts, the U.S. Fish and Wildlife Service response, and suggestions for related stewardship activities.

The State of the Birds 2010 Report on Climate Change, USFWS et al.
http://www.stateofthebirds.org/
This report calls attention to the collective efforts needed to protect nature's resources for the benefit of people and wildlife.

Global Warming and Waterfowl, National Wildlife Federation
http://www.nwf.org/Global-Warming/Effects-on-Wildlife-and-Habitat/Birds-and-Waterfowl.aspx
The National Wildlife Federation's predictions of the impacts of climate change on waterfowl within specific flyways are summarized on this site. The page includes a link to the *Waterfowler's Guide to Global Warming: Potential and Current Threats to America's Waterfowl*.

Conservation Careers and Volunteer Opportunities

Conservation Careers and Volunteer Opportunities, U.S. Fish and Wildlife Service
http://www.fws.gov/volunteers
This page lists career and volunteer opportunities within the U.S. Fish and Wildlife Service.

Careers in Wildlife Conservation, The Wildlife Society
http://joomla.wildlife.org/index.php?option=com_content&task=view&id=73
This page lists a variety of possible wildlife conservation careers with a brief description of each position.

Weather Volunteers: Meteorology gets a boost from thousands of weather watchers across the country.
http://www.acfnewsource.org/science/weather_volunteers.html
Students may enjoy reading this article about a volunteer weather observer in the National Weather Service's program, Cooperative Weather Observer.

Youth Conservation Corps: Understanding the Public Lands Corps Act and the Youth Conservation Corps
http://www.fws.gov/humancapital/factsheetpdfs/YouthFactSheetFinal.pdf
This fact sheet describes the Department of the Interior effort to engage young people across the country in conservation and energy efficiency projects on America's public lands, to inspire and provide career pathways in natural resource occupations and related sciences, and to become better educated about the nation's ecosystems.

Invasive Species

When Weeds Move In Waterfowl Move Out. Bureau of Land Management
http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/fish__wildlife_and/weeds.Par.42925.File.dat/RamosFinalID_Ad.pdf
This flyer offers information on the effects of invasive weeds on waterfowl and conservation tips for avoiding the spread of invasives. It could be printed as a poster for the classroom.

Frequently Asked Questions about Invasive Species, Wisconsin Department of Natural Resources
http://dnr.wi.gov/invasives/faq/
This site answers the basic questions about invasive species and offers links to information about specific invasives such as purple loosestrife, http://dnr.wi.gov/invasives/fact/loosestrife.htm

Investigation and Science Inquiry

BirdSleuth: Investigating Evidence (6–8th), Cornell Lab of Ornithology
http://www.birds.cornell.edu/birdsleuth/inquiry-resources/we-want-to-support-you-as-your-students-become-scientists
This curriculum includes lesson plans, journal pages, and online resources that will help your students ask scientific questions, craft and test hypotheses, collect and organize data, draw meaningful conclusions, and publish their work.

Oil Spills

Classroom for Educators and Students, Restorethegulf.gov
http://www.restorethegulf.gov/response/education-resources/classroom
This site offers a variety of activities and lesson plans related to oil spill issues, as well as links to a number of fact sheets about the Gulf spill and restoration.

FWS Deepwater Horizon Oil Spill Response, U.S. Fish and Wildlife Service
http://www.fws.gov/home/dhoilspill/factsheets.html
This fact sheet provides general information about the U.S. Fish and Wildlife Service response to the Deepwater Horizon oil spill (2010).

Effects of Oil on Wildlife and Habitat, USFWS
http://www.fws.gov/home/dhoilspill/pdfs/DHJICFWSOilImpactsWildlifeFactSheet.pdf
The U.S. Fish and Wildlife Service provides information on the impacts of oil spills on wildlife and the environment.

Legacy of an Oil Spill 20 Years After Exxon Valdez, Exxon Valdez Oil Spill Trustee Council
http://www.evostc.state.ak.us/facts/details.cfm
This site provides information on the oil spill, habitat protection, restoration projects, and the status of restoration efforts.

Waterfowl Population Surveys

Part Collection Survey, Flyways.US
http://flyways.us/surveys-and-monitoring/hunter-surveys/parts-collection-surveys
On page 126 of the *Educator Guide* there is a description of the Flyways.US Waterfowl Harvest Surveys. This site describes the use of wing and/or tail feathers collected from hunters for estimating waterfowl population sizes.

Waterfowl Banding Program, Flyways.US
http://flyways.us/surveys-and-monitoring/banding-and-marking-programs/waterfowl-banding-program
Scientists band the legs of thousands of ducks and geese each year. Learn more about that process at this site.

Notes: